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Supplementary Information

Can temperate forests deliver both future wood demand and climate-change mitigation?

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Supplementary Table 1 - Life Cycle Inventory for 'business as usual' (BAU) wood use

Inventory of key inputs and outputs for processes considered along the life cycle of forestry value chains derived from thinned forest systems over 100 years. Emissions factors (EF) and their sources are indicated. GWP is global warming potential (measured in kg CO₂e).

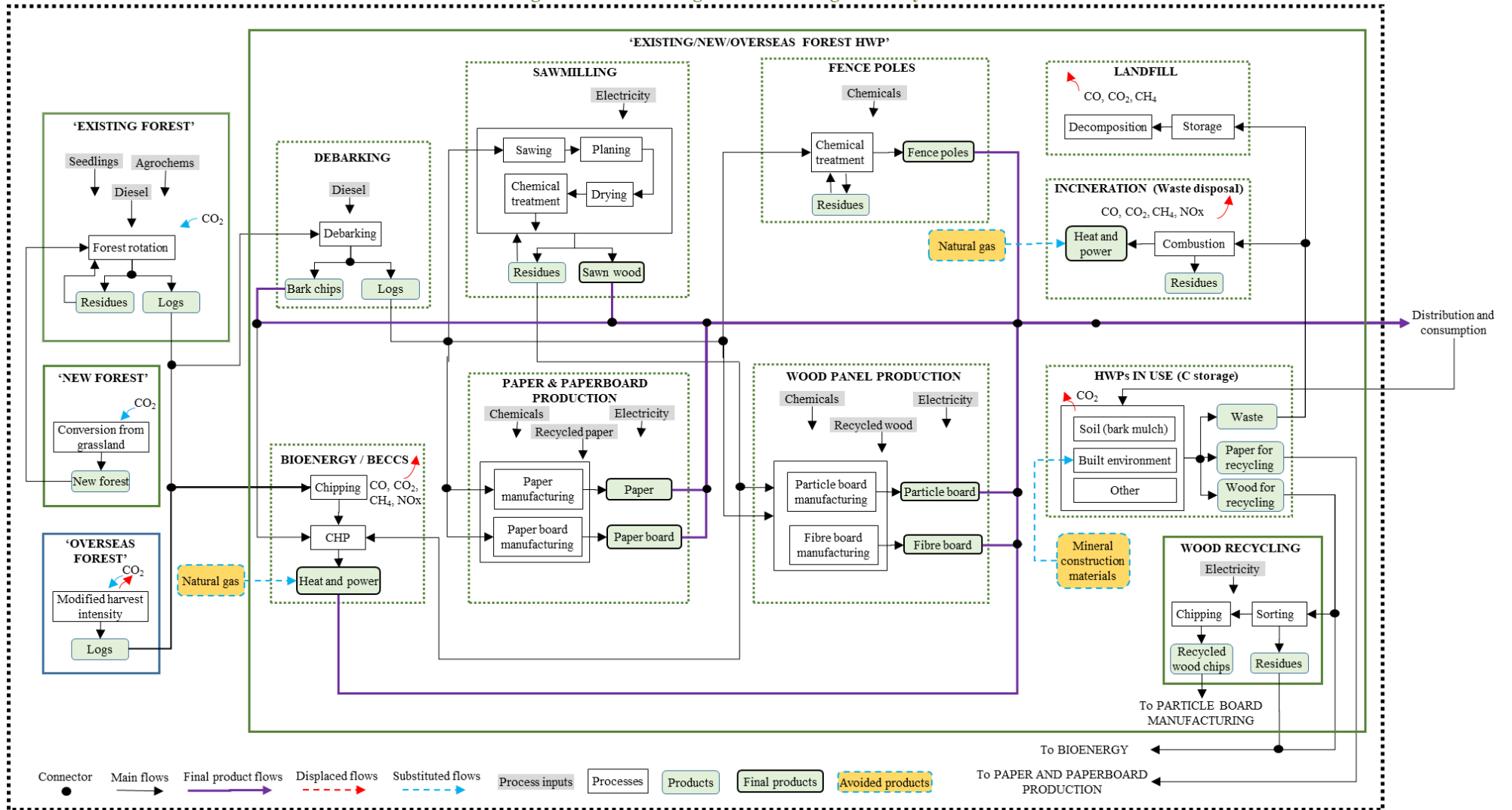
Process stage	Input/output/process	Activity data source	Units	Thinned		EFs	EF source
				In	Out		
Planting (1&2)	Tree seedlings	GH ²	Item(s)	774,012,298		0	Ecoinvent ¹
	15 tonne 360 Excavator	GH ²	hrs	464,407		65	Ecoinvent ¹
	Pesticides (acetamiprip)	Industry recommended	kg	25,759			Ecoinvent ¹
Forest management	Harvester (diesel use)	GH ²	hrs	1,207,459		56	Ecoinvent ¹
	Forwarder (diesel use)	GH ²	hrs	1,207,459		46	Ecoinvent ¹
	Harvested wood	CBM-CFS ³	m ³		13,751,783		IPCC
Transport (forest to processor)	>32 t truck, EURO6	GH ²	t.km	1,909,601,142			Ecoinvent ¹
Debarking	Harvested wood	CBM ³ , GH ²	m ³	11,634,008			
	Diesel	Ecoinvent ¹	MJ	10,250,052			
	Lubricating oil	Ecoinvent ¹	kg	9,095			
	Bark chips	GH ² , FR CFs ⁵	kg		865,458,517	20	Ecoinvent ¹
	Debarked wood	GH ² , FR CFs ⁵	m ³		10,387,507		
Sawing	Diesel (internal transport)	Ecoinvent ¹	MJ	105,021,592			
	Electricity	Ecoinvent ¹	kWh	70,229,933			
	Lubricating oil	Ecoinvent ¹	kg	382,034			
	Debarked wood	GH ² , FR CFs ⁵	m ³	7,305,635			
	Sawnwood	JJ&S ⁴	m ³		4,018,099	25	Ecoinvent ¹
	Sawmill residues	JJ&S ⁴	kg		1,141,285,057		
Drying (of sawn timber)	Electricity	Ecoinvent ¹	kWh	67,102,253			
	Sawnwood	JJ&S ⁴	m ³	4,018,099			
	Sawnwood - dried (u=20%)	Assume no loss in volume during drying	m ³		4,018,099	29	Ecoinvent ¹
Planing	Electricity	Ecoinvent ¹	kWh	34,840,025			
	Sawnwood (carcassing) dried (u=20%)	JJ&S ⁴	m ³	4,018,099			
	Sawnwood (carcassing) planed	Vol loss accounted for in 'sawing'	m ³		4,018,099	35	Ecoinvent ¹
	Sawmill residues	JJ&S ⁴	kg		1,141,285,057		
Chemical treatment	Electricity	Ecoinvent ¹	kWh	708,223			
	Wood preservative	Ecoinvent ¹	kg	991,511,510			
	Sawnwood (fencing) dried (u=20%)	JJ&S ⁴	kg	688,296,981			
	Debarked wood (fence poles)	GH ² , FR CFs ⁵	kg	303,214,529			
	Preserved wood	No vol. change	kg		991,511,510	0	Ecoinvent ¹
Particle board production	Electricity	Ecoinvent ¹	kWh	345,191,890			
	Heat	Ecoinvent ¹	MJ	4,050,362,146			
	Resin	Ecoinvent ¹	kg	169,276,792			
	Debarked wood (chip)	GH ²	kg	596,750,357			
	Sawmill residues	JJ&S ⁴	kg	700,595,575			
	Recycled wood	FC report	kg	1,108,766			
	Particle board	FR CFs ⁵	m ³		3,415,000	262	Ecoinvent ¹
Fibre board production	Electricity	Ecoinvent ¹	kWh	685,822,000			
	Heat	Ecoinvent ¹	MJ	4,757,462,000			
	Debarked wood (chip)	GH ² FR CFs ⁹	kg	596,750,357			
	Sawmill residues	JJ&S ⁴	kg	647,847,106			
	Fibre board	JJ&S ⁴ , GH ² , FR CFs ⁵	m ³		1,370,000	98	Ecoinvent ¹
Woodchip production (for biomass energy)	Electricity	Ecoinvent ¹	kWh	71,358,404			
	Lubricating oil	Ecoinvent ¹	kg	5,642			
	Harvested wood - 'fuel'	GH ²	kg	765,829,625			
	Recycled wood - 'biomass'	FC	kg	2,000,000,000			
	Wood chips	GH ²	kg, dry		2,765,829,625	0	Ecoinvent ¹
Biomass energy	Electricity	Ecoinvent ¹	kWh		20,284,594,466		Ecoinvent ¹

Process stage	Input/output/process	Activity data source	Units	Thinned		EFs	EF source
				In	Out		
	Wood chips	GH ²	Kg, dry	2,765,829,625			Conversion biogenic C to CO ₂ eq
	Heat	Ecoinvent ¹	MJ		52,550,762,866	0	Ecoinvent
Avoided fossil fuels	Electricity generation (natural gas, high pressure)	Ecoinvent ¹	m ³	3,146,931,268			Ecoinvent ¹
Avoided construction materials	140 mm concrete block and mortar wall replaced by timber frame wall	BRE ⁶	m ²	18,779		37	Ecoinvent ¹

Supplementary Fig. 1 – Lifecycle assessment system boundary (modified from Forster et al. (2021)⁷).

We calculate the GWP impact of system changes from year 0 'baseline' BAU existing forest value chain, due to shifts in forest management and area to meet projected wood demand increases. 'Overseas' land-use change refers to changes to harvest intensity from tropical and boreal forests to make up marginal demand shortfalls from temperate forests. See Figure 1 and Table 1 in the main article for further details of modelled scenarios.

LCA BOUNDARY – changes from BAU management of existing forest in year 2023



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